SANITARY COMMISSION.

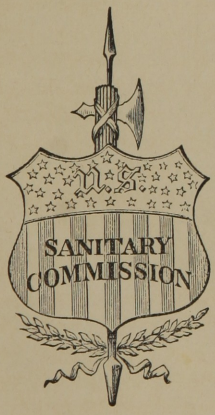
T.

ON THE USE OF

PLASTER OF PARIS SPLINTS

IN

MILITARY SURGERY.



PRINTED FOR CIRCULATION BY

THE UNITED STATES SANITARY COMMISSION.

1864.

The attention of the Sanitary Commission has been directed to the fact, that most of our Army Surgeons, now in the field, are unavoidably deprived of many facilities they have heretofore enjoyed for the consultation of standard medical authorities. It is obviously impossible to place within their reach anything that can be termed a medical library. The only remedy seems to be the preparation and distribution among the medical staff, of a series of brief essays or hand-books, embodying in a condensed form the conclusions of the highest medical authorities in regard to those medical and surgical questions which are likely to present themselves to surgeons in the field, on the largest scale, and which are, therefore, of chief practical importance.

The Commission has assigned the duty of preparing papers on several subjects of this nature, to certain of its associate members, in our principal cities, belonging to the medical profession, whose names are the best evidence of their fitness for their duty.

The following paper, "*On the Use of Plaster of Paris Splints in Military Surgery*," prepared by Dr. James L. Little, late House-Surgeon of the New York Hospital, belongs to this series, and is respectfully recommended by the Commission to the Army.

J. FOSTER JENKINS, M. D.,
Secretary.

New York, August, 1864.

ON THE USE OF

PLASTER OF PARIS SPLINTS

IN

MILITARY SURGERY.

The use of plaster of Paris in the treatment of fractures dates from a very early period.

Eaton, an English consul at Bassora, about the close of the last century, saw it employed by the Arabians. It was first employed in Europe by Hendrikes, at the hospital of Grönin-gen, in 1814, and afterwards by Hubenthal, Kyle, and Dief-fenbach.

By these surgeons it was used in a very clumsy manner. Dieffenbach poured the plaster over the limb, so as to inclose it in a solid casing; and it was necessary to use the hammer and chisel, in order to break the mould to remove it, thus jarring the limb and running the chances of injuring a newly consolidated fracture. These moulds have been justly called by Hamilton, "heavy stone coffins, they might serve well enough the purpose of interment, but they are wholly unsuited to the purposes of a splint." Pirogoff, of St. Petersburg, in the year 1854, published a monograph on a new method of bandaging fractured limbs with linen soaked in a solution of plaster of Paris. His method was as follows: The limb was first bandaged and the depressions filled with raw cotton, then splints of the coarsest linen, saturated in a solution of the plaster were applied lengthwise to the limb, and fastened cross-wise with strips saturated with the same material.

Dr. Glück published a lecture on Military Surgery, in the *American Medical Monthly*, for December, 1855,* in which he describes a method of using the plaster of Paris similar to that of Pirogoff.

Dr. Weber, of this city, reported a case treated in this manner in the *New York Journal of Medicine*, for May, 1856. Other similar methods have also been recommended. Bandages with the meshes filled with dry plaster have been applied to the limb and then wetted with cold water; the plaster hardening in a few minutes, formed a solid casing for the limb.

Maisonneuve, of Paris, has recently revived the use of this substance in the construction of splints for fractures. His method is similar to that of Pirogoff, and has been fully described by Drs. Smith and Swan, in their letters from Paris, published in the *American Medical Times*, during the year 1861. It was applied, for the first time, in the New York Hospital, in May, 1861, by the author of this paper, and it answered the purpose so admirably, that its use was continued until, at the present time, it has almost entirely supplanted the starch bandage and other modes of dressings for simple fractures of the leg. In this institution it is applied as soon as the swelling of the limb has subsided, and it then makes a permanent splint for the limb. Its advantages are: its facility of application, and its perfect adaptation to the limb, being borne by the patient better than any other form of apparatus. It never gives rise to undue pressure over the salient points of the limb, and its property of absorbing moisture keeps the limb perfectly dry, preventing the confinement of the perspiration, and thus doing away with one cause of irritation and excoriation. It may be applied with impunity over denuded surfaces and abrasions, without danger of producing any irritation, slight excoriations or abrasions healing readily under it.

Its advantages over the starch bandage are its rapidity of drying and hardening, the plaster taking about five minutes

* Republished in *American Medical Times*, during May, 1861.

"to set," *while being held by the surgeon in its proper position;* the starch apparatus requiring several days to dry unless artificial heat is applied. Another advantage is, that the limb can be inspected daily if necessary, without removing all the apparatus. It, therefore, can be applied much earlier than the starch bandage.

This form of dressing for fractures, used as a means of transporting the wounded, has been but little used in this war. Dr. Swan applied it to several cases of fractures after the seven days' fight before Richmond, during M'Clellan's campaign, and the patients were comfortably transported to Washington.

Louis Stromeyer Little, Assistant Surgeon to London Hospital, writing from the seat of war at Schleswig, states that "Plaster of Paris is universally employed in compound fractures. In ten of the femur particularly, it answered very well; the patient could bear to have the limb moved about, and all seemed in a fair way to recover."*

In military surgery, the advantages it possesses over other forms of dressings are the rapidity with which it dries and adapts itself to the parts, and the fact that it forms such a firm, hard casing, permitting the limb to be handled and moved with great ease during any transportation that may be necessary to place the patient in more comfortable quarters. And if applied so as to leave a portion of the limb uncovered, there is no danger from swelling. Windows can be cut in the splint, so as to allow the wounds to be exposed and dressed. Cooling lotions may be applied without injury to the dressings.

Materials necessary for the Application of Plaster of Paris Splints on the Field.

1st. Old coarse muslin, or Canton flannel.

2d. Fine, well dried Plaster of Paris, put up in air-tight tin cans, each containing from four to ten pounds of plaster.

* *London Lancet*, April, 1864.

3d. Roller bandages, suitable for the upper and lower extremities, say two inches wide and five yards long for the upper extremity, and three inches wide and six yards long for the lower extremity.

4th. Tin basins for mixing the plaster.

Mode of Application.—As these splints consist of several thicknesses of muslin or canton flannel, saturated with a mixture of plaster and water, and applied to the limb, the shape of the splint and the part of the limb to which it is applied must vary in different cases. Sometimes it may be the best to apply the dressing in separate pieces to the different sides of the limb, and to retain them with transverse bands of the same material. In other cases, and this in our experience is the simpler mode, the dressing should be in one piece, so as to make a partial casing for the limb, causing it to fit the limb accurately, by applying over it a roller bandage. This may be removed as soon as the splint becomes hard.

The limb should be shaven or lightly oiled, to prevent the hairs from sticking to the splints. The Canton flannel or old muslin is then to be cut of the proper size and shape. If the material used is very coarse, it will not be necessary to make it of more than two or three thicknesses. Two thicknesses of Canton flannel make the best kind of splints. Windows should be cut out, so as to allow the wounds to remain uncovered. After this has been done, the plaster should be prepared. Equal parts of plaster and water are about the right proportions.* If it is necessary that the plaster should "set" quickly, a small quantity of salt should be dissolved in the water before adding the plaster. If in any case delay is necessary, the addition of a small quantity of carpenters' glue, mucilage or starch, will subserve that end. The plaster should be sprinkled in the water until the proper quantity is added, and then allowed to

* It has been stated that a very *light* and *porous* splint may be made by preparing the plaster paste, as follows:

Gypsum, 75 parts, by weight.
Water, 100 parts, "
Starch, 1½ to 2 parts, "

remain a few seconds before mixing it. The mixture should be about the consistence of cream. The cloth unfolded, if in one piece, should then be immersed in the solution and thoroughly saturated. It is then to be folded and laid on a flat surface, such as a board or table, and smoothed out with the hand, in order to remove any irregularities of its surface, and then, with the help of an assistant, applied to the limb, and a roller bandage put on snugly over it. The limb is then to be held in proper position (extension being made, if necessary, by the surgeon) until the plaster solidifies. The time required in preparing the cloth, mixing the plaster, and applying it to the limb, need not take more than fifteen minutes. After the dressing has become hard, it is best to remove the roller and re-apply it more loosely, and in many cases it may be dispensed with altogether. Cold water and other lotions may be freely applied to the exposed portions of the limb without injury to the splint.

This dressing may be used with advantage in fractures of the humerus, forearm, and leg, and injuries involving the elbow, knee, and ankle joints. After excisions, there is no form of dressing which is so applicable. We will now describe its application to special fractures, commencing with

Fractures of the Leg.—The limb should be shaven or lightly oiled, and the wounds covered with lint. A piece of Canton flannel should then be selected, of a size so that when doubled it should be wide enough to encircle the leg for a little more than half its circumference, and of sufficient length to extend from below the knee to about five inches below the heel. In order to make the splint fit the limb neatly, it is a good plan to cut the Canton flannel after a paper pattern previously prepared. The shape of this pattern is represented in fig. 1. Openings should be cut at the proper places, so as to

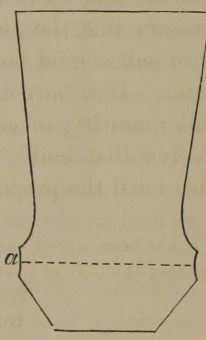


Fig. 1.

allow the wounds to remain uncovered. The flannel is then unfolded and immersed in the mixture of plaster and water, prepared as above stated, then folded and laid evenly under the leg. The bones are then to be put in the proper position, and the flannel is smoothly applied to the leg. The portion indicated by the dotted line (*a*) extending below the heel is turned up against the sole of the foot, and the sides folded over the dorsum, and a fold made at the ankle on either side, and a roller bandage applied firmly over all. The limb is then to be held in proper position until the plaster becomes hard. This takes but a few minutes. The roller can then be removed and the splint or casing will be as represented in fig. 2. The anterior surface of the limb is exposed, so that the position of the fragments can readily be ascertained without removing the casing The wound can now be dressed and a roller bandage may be applied from the toes to the knee, or strips of adhesive plaster may be passed around the splint, and the roller dispensed with. Transverse bands of cloth, saturated in plaster, as seen in fig. 5, may also be applied. As the swelling of the limb subsides, and the splint becomes loose, it can be rendered tight by means of a roller. Thus dressed, a fractured leg may be moved about with safety and comfort to the patient.

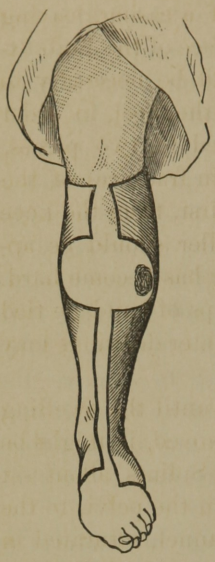


Fig. 2.

In wounds or other injuries of the knee joint, or after excision, one of the most important points in the treatment is the perfect quietude of the part. Any form of splint can be made by this dressing, which will fit the part accurately, and be as firm as can be desired.

Fractures of the Femur.—In fractures of the middle and lower end of this bone, this dressing may be used for the purpose of adding to the patient's comfort during transportation.

If used on the field before swelling of the limb has occurred, it would be well to apply it in the form of a casing, leaving the wound and a portion of the anterior surface of the limb exposed, as in fractures of the leg. It would be necessary to make the splint extend from the pelvis to the heel, in order to hold the limb firmly. It may be applied in two pieces, one extending from the foot to the knee, as in fractures of the leg, and the other slightly overlapping the first, from the knee to the pelvis. Over these successively a roller should be applied, and extension kept up until the casing has become hard. The roller should then be removed, and strips of bandage tied around the splint at several places. Cold water dressings may now be appled to the exposed wounds.

If the patient has remained in a hospital until the swelling has begun to subside, and is then to be removed, it might be well to apply it in the following manner: Splints about six inches wide, and long enough to extend from the pelvis to the heel, made of two thicknesses of Canton flannel, saturated in the mixture of plaster of Paris and water, are to be laid along the anterior and posterior surfaces, or on the sides of the limb, and four or five transverse bands of the same material passed around the limb at different places, and the whole applied snugly to the limb by means of a roller. After the plaster "sets" the roller should be removed and reapplied or dispensed with, according to the judgment of the surgeon.

The difficulty in applying such large dressings is, that some portion of the splint is liable to solidify before the whole is properly applied. It may therefore be necessary to delay the "setting" by the addition of a small quantity of mucilage or carpenters' glue, or by adding some fresh boiled starch to the water before mixing in the plaster.

I would state that I do not consider this dressing at all applicable to the *treatment* of fractures of the thigh bone, but recommend its use only as a means of transporting patients with this injury. The treatment by extension, as recommended by Dr. Gurdon Buck, of this city, is one of the best, and certainly one of the simplest methods for treating any

form of fracture of the femur, and should be applied as soon as the patient arrives at the hospital where he is to remain.

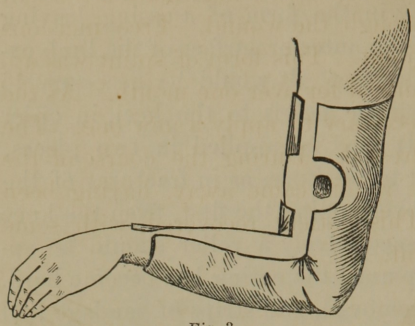


Fig. 3.

In fractures of the humerus this expedient may be used, and should extend from the shoulder to the hand. Fenestræ may be cut so as to expose the wounds, as represented in fig. 3.

For fractures in the vicinity of and involving the elbow-joint, which require the arm to be kept in a fixed position, this is decidedly the best mode of dressing. For this purpose angular splints made of tin, gutta perch, or paste-board, are commonly used, and all require some little time for their construction. The plaster of Paris splint can be made in five minutes, and will fit itself to the inequalities of the arm more accurately than any other.

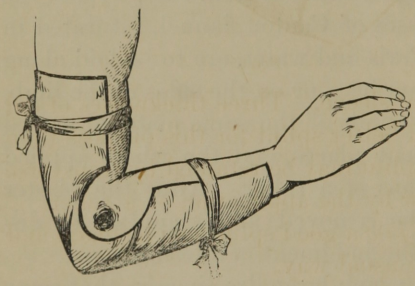


Fig. 4.

Fig. 4 represents an angular splint applied to a gun-shot wound involving the elbow-joint.

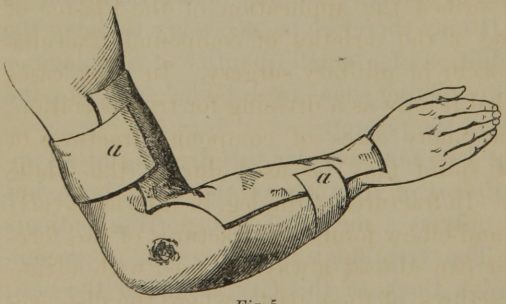


Fig. 5.

Fig. 5 shows a splint applied to the anterior surface of the arm, and retained by the transverse bands *a*. *a*. This drawing was taken from a patient who was wounded at the battle of *Cross-Keys*. A round bullet entered the elbow-joint. The patient came under my observation two weeks after the injury.

The joint was very much swollen, and on examination the ball was found and removed through the wound. Free incisions were necessary around the joint. This form of splint was applied, and worn without removal for over one month. At the end of that time it was necessary to apply a new one. The wounds could readily be dressed. During the course of the treatment the head of the radius came away, having been broken off by the ball. This patient recovered, with some degree of motion in the joint.

In fractures of the forearm it may be applied in a manner represented in fig. 6, and forms a very comfortable and convenient dressing, the patient generally being able to keep his arm in his coat-sleeve. Three thicknesses of old muslin makes a lighter and better splint for this purpose than the Canton flannel. This splint may be retained by transverse bands, as in figs. 4 and 5, or by the application of a roller.

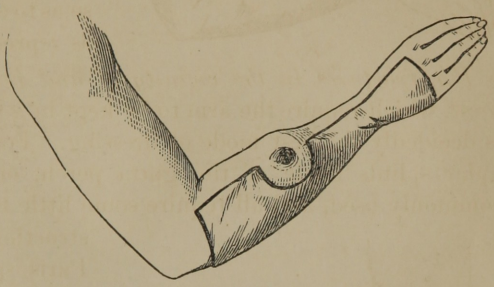


Fig. 6.

In fractures of the lower jaw a good splint can be made and retained by bandages in the usual way.

We have now described the application of the Plaster of Paris splints to some of the varieties of compound fractures which are likely to occur in military surgery. In most cases we have recommended it only as a dressing for transportation. There are, however, many cases of compound fractures in which this kind of splint may be used during the whole course of treatment. In fractures of the leg, in injuries involving the knee, ankle and elbow joints; in fractures of the forearm and humerus, it can almost always be used with advantage. In simple fractures of these parts, where the displacement can be easily reduced, there is no better form of dressing.

THE UNITED STATES SANITARY COMMISSION.

T.